

What is claimed is:

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1. An optical pickup device for recording and/or reproducing information in an optical information recording medium, comprising:

a light source to emit light flux having a central wavelength not longer than 500 nm;

a converging optical system to converge the light flux emitted from the light source onto an information recording surface of the optical information recording medium;

and

an optical detector to detect light flux reflected from
✓ the information recording surface of the optical information recording medium or the light flux passing through the information recording surface of the optical information recording medium;

wherein the converging optical system or the optical detector comprises at least one optical element and the optical element comprises at least one optical surface having a center-line mean roughness Ra of 5 nm or less.

2. The optical pickup device of claim 1, wherein the optical element has the optical surfaces having a center-

line mean roughness Ra of 5 nm or less on both side surfaces thereof.

3. The optical pickup device of claim 1, wherein the optical surface of the optical element having a center-line mean roughness Ra of 5 nm or less is an aspherical surface.

4. The optical pickup device of claim 2, wherein each of the both side surfaces of the optical element having a center-line mean roughness Ra of 5 nm or less is an aspherical surface.

5. The optical pickup device of claim 1, wherein the optical element is made of a resin material.

6. The optical pickup device of claim 1, wherein the optical element is made of a glass material.

7. The optical pickup device of claim 1, wherein at least one surface of the optical surface of the optical element has a reflectance of 5% or less for light having a wavelength of 400 nm.

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wherein the optical surface has a center-line mean roughness Ra of 5 nm or less.

14. The optical element of claim 13, wherein the optical element has the optical surfaces having a center-line mean roughness Ra of 5 nm or less on both side surfaces thereof.

15. The optical element of claim 13, wherein the optical surface of the optical element having a center-line mean roughness Ra of 5 nm or less is an aspherical surface.

16. The optical element of claim 14, wherein each of the both side surfaces of the optical element having a center-line mean roughness Ra of 5 nm or less is an aspherical surface.

17. The optical element of claim 13, wherein the optical element is made of a resin material.

18. The optical element of claim 13, wherein the optical element is made of a glass material.

19. The optical element of claim 13, wherein at least one surface of the optical surface of the optical element has a

reflectance of 5% or less for light having a wavelength of 400 nm.

20. The optical element of claim 13, wherein at least one surface of the optical surface of the optical element has a reflectance of 3% or less for light having at least a wavelength of 300 nm to 500 nm.

21. The optical element of claim 13, wherein the optical surface of the optical element is not subjected to a polishing process.

22. The optical element of claim 13, wherein the optical element is an objective lens.

23. The optical element of claim 13, wherein the optical element is a collimator lens.

24. the optical element of claim 13, wherein the optical element is an optical element for a sensor.

25. An optical information recording and/or reproducing apparatus for recording and/or reproducing information in an optical information recording medium, comprising:

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an optical pickup device comprising

a light source to emit light flux having a central wavelength not longer than 500 nm;

a converging optical system to converge the light flux emitted from the light source onto an information recording surface of the optical information recording medium;

and

an optical detector to detect light flux reflected from the optical information recording medium or the light flux passing through the optical information recording medium;

wherein the converging optical system or the optical detector comprises at least one optical element and the optical element comprises at least one optical surface having a center-line mean roughness R_a of 5 nm or less.

26. A molding die for an optical element; comprising:

a molding surface,

wherein the molding surface comprises at least one surface having a center-line mean roughness R_a of 5 nm or less.

27. The molding die of claim 26, wherein the one surface is an aspherical surface.

28. A method of manufacturing a molding die for an optical element, comprising the steps of:

cutting a material of the molding die with a super precision lathe and a diamond tool; and

forming an optical surface transferring surface in the molding die;

wherein the optical surface transferring surface comprises at least one surface having a center-line mean roughness Ra of 5 nm or less.

29. The method of claim 28, wherein a tool roundness of the diamond tool is 30 nm or less.

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